What is claimed is:

1. A transmission actuator comprising:

a torque generating mechanism including, in turn, a rotor provided on an outer circumferential surface of a drive shaft and a stator provided on a transmission case;

a speed reduction mechanism disposed on either an input shaft or an output shaft for multiplying a torque from the torque generating mechanism;

a motion direction changing mechanism comprising, in turn, two rotational elements adapted for converting a torque multiplied by a cam mechanism provided between confronting faces of a pair of externally toothed gears which constitute the speed reduction mechanism into a thrust and having provided on outer circumferential surfaces thereof the externally toothed gears to which the torque from the speed reduction mechanism is transmitted; and

a friction engagement mechanism provided on the input shaft and the output shaft so as to be brought into engagement by virtue of a thrust generated by the motion direction changing mechanism to thereby transmit a power from the input shaft to the output shaft,

wherein the drive shaft is made hollow so that the input shaft or the output shaft is disposed in a hollow portion of the drive shaft.

2. A transmission actuator comprising:

a torque generating mechanism including, in turn, a rotor provided on an outer circumferential surface of a drive shaft and a stator provided on an inner circumferential surface of a transmission case;

a speed reduction mechanism formed integrally on the drive shaft and comprising a first internally toothed gear and a second internally toothed gear, and a first externally toothed gear and a second externally toothed gear which are rotatably supported on an outer circumferential surface of an input shaft or an output shaft so as to mesh with the first internally toothed gear and the second internally toothed gear, respectively, for transmission of a torque, whereby a torque from the torque generating mechanism is multiplied through a differential motion produced by a difference in gar ratio between a set of the first internally toothed gear and the first externally toothed gear and a set of the second internally toothed gear and the second externally toothed gear;

a motion direction changing mechanism for converting a torque multiplied by a cam mechanism provided between confronting faces of the first and second externally toothed gears into a thrust; and

a friction engagement mechanism provided on the input shaft and the output shaft so as to be brought into engagement by virtue of a thrust generated by the motion direction changing mechanism to thereby transmit a power from the input shaft to the output shaft,

wherein the drive shaft is made hollow so that the input shaft or the output shaft is disposed in a hollow portion of the drive shaft.

3. A transmission actuator comprising:

a torque generating mechanism including, in turn, a rotor provided on an outer circumferential surface of a drive shaft and a stator provided on an inner circumferential surface of a transmission case;

a speed reduction mechanism disposed on either an input shaft or an output shaft in which an internally toothed gear or an externally toothed gear provided on the drive shaft and including two gears for transmitting a torque to a first externally toothed gear to a second externally toothed gear disposed adjacent to the first externally toothed gear is provided on the first externally toothed gear and the second externally toothed gear, whereby a torque from the torque generating mechanism is multiplied through a differential motion produced by a difference in gar ratio between a set of one of the two gears and the first externally toothed gear and a set of the other gear and the second externally toothed gears;

a motion direction changing mechanism for converting a torque multiplied by a cam mechanism provided between confronting faces of the first and second externally toothed gears into a thrust; and

a friction engagement mechanism provided on the input shaft and the output shaft so as to be brought into engagement by virtue of a thrust generated by the motion direction changing mechanism to thereby transmit a power from the input shaft to the output shaft,

wherein the drive shaft is made hollow so that the input shaft or the output shaft is disposed in a hollow portion of the drive shaft.

4. A transmission actuator comprising:

a torque generating mechanism including, in turn, a rotor provided on an outer circumferential surface of a drive shaft and a stator provided on an inner circumferential surface of a transmission case;

a speed reduction mechanism disposed on either an input shaft or an output shaft in which a carrier carrying planet gear assemblies while holding them thereon is formed integrally on the drive shaft, two planet gears for transmitting a torque from the torque generating mechanism are disposed at a plurality of locations, and two sun gears are disposed closely to each other between the planet gear assemblies and the input shaft, whereby a torque from the torque generating mechanism is multiplied through a differential motion produced by a difference in gear ratio between a set of one of the two planet gears and one of the two sun gears and a set of the other planet gear and the other sun gear, while the planet gears and the sun gears mesh with each other;

a motion direction changing mechanism for converting a torque multiplied by a cam mechanism provided between confronting faces of the two sun gears into a thrust; and

a friction engagement mechanism provided on the input shaft and the output shaft so as to be brought into engagement by virtue of a thrust generated by the motion direction changing mechanism to thereby transmit a power from the input shaft to the output shaft,

wherein the drive shaft is made hollow so that the input shaft or the output shaft is disposed in a hollow portion of the drive shaft.

5. A transmission actuator as set forth in Claim 4, wherein the speed reduction mechanism is a carrier carrying planet gear assemblies while holding them thereon is connected to the drive shaft, that two planet gears for transmitting a torque from the torque generating mechanism are disposed at a plurality of locations, that a ring gear is formed in an inner circumferential surface of a transmission case, and that two sun gears are disposed closely to each other between the planet

gear assemblies and the input shaft, so that the planet gear assemblies and the sun gears are brought into mesh engagement with each other, allowing the planet gear assemblies not only to revolve on their own axes but also to rotate around the sung gears, whereby a torque from the torque generating mechanism is multiplied through a differential motion produced by a difference in gear ratio between a set of one of the two planet gears and one of the two sun gears and a set of the other planet gear and the other sun gear which results while the planet gears and the sun gears mesh with each other.